Theoretical Computer Science

Concrete version of KKL Theorem

Asked 3 years, 2 months ago Modified 3 years, 2 months ago Viewed 252 times

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The Kahn–Kalai–Linial (KKL) Theorem says that for any balanced Boolean function $f:\{-1,1\}^n \to \{-1,1\}$ we have $\max_i \mathbf{Inf}_i(f) = \Omega\left(\frac{\log n}{n}\right)$. I am looking for a concrete version of this theorem that holds for all n. What is the tightest concrete version known?

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edited May 11, 2023 at 17:32

asked May 10, 2023 at 22:40

user6584

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3 I mean, the bound $\Omega\left(\frac{\log n}{n}\right)$ does hold for all n, provided the implicit constant is small enough. Can't you just work through a proof of the KKL theorem and keep track of the constant? It might be a pain, but should be straightforward. – mathworker21 May 11, 2023 at 16:07

1 Yes, that is certainly possible, but I suspect this is already well-known in the literature and if so I would like to cite it (and avoid repeating work!) – user6584 May 11, 2023 at 17:33

1 Answer

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See Exercise 9.30 of Ryan O'Donnell's *Analysis of Boolean Functions* book [1]: for any $f\colon \{-1,1\}^n \to \{-1,1\}$,

$$\mathbf{MaxInf}[f] \geq \frac{1}{2}\mathbf{Var}[f] \cdot \frac{\ln n}{n}(1 - o(1))$$

and what's in the $o(1)$ should be easy to figure out from the subquestion (b) of the exercise.

[1] O'Donnell, R. (2014). *Analysis of Boolean Functions*. Cambridge: Cambridge University Press. doi:10.1017/CBO9781139814782. See also arXiv:2105.10386.

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answered May 13, 2023 at 22:17

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4,634 31 55

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